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ON MINERAL AND METALLIC VEINS.

IN fulfilment of the promise made in our March number, we proceed to the investigation of this very curious branch of geology. Our readers will soon perceive the importance of a knowledge of it, in a country possessing such vast metallic resources as North America, where indications of them are appearing in such various quarters, and at a period when the ideas entertained respecting their extent and origin are still undefined and obscure, except with those few persons who have made a particular study of the subject.

It is a very admirable proof of benevolent intentions on the part of the Creator, that iron, without the use of which man could scarcely have achieved his own civilization, is the most abundant of all the metals, and is found, more or less, in all the rocks. Copper and lead are sometimes abundantly found in the strata adjacent to the coal beds, [tabular view, page 388,] but the metals have their principal seat in the primary rocks. They are found disseminated either in extensive masses, or in veins which traverse mineral masses.

In our paper *on the Crust of the Earth*, page 289, we spoke of the expansive power by which it was continually agitated, the disturbed state of the lower stratified rocks, and the numerous displacements which constitute so many ancient geological periods. Such a power could not be in operation, without producing extensive fissures, of a character analogous to that we find presented by the numerous veins which traverse the lower parts of the crust of the earth. This has been the probable origin of all

important veins, and it can lead to no injurious consequences, if, with the exception of a few cases of contraction and consequent separation of masses, we admit this origin. It would not be equally safe, if, considering veins to be ancient fissures, we were to come, with some geologists, to the conclusion, that all those containing metallic matter, have been filled by injection from below, when the fissures were produced. This would be to impede the progress of knowledge, since we can suppose other modes by which metallic substances can be produced in veins. If all veins had their origin from below, miners might form calculations upon penetrating to depths, the which, if they could be reached, would perhaps be delusive, whilst the effort would be ruinous. That many metallic deposits have come from below, is perhaps demonstrable; whilst it is equally demonstrable, that metals are formed by other processes, analogous to those upon which the formation of saline crystals depends. Mines which have been closed, on account of inundation, for two centuries, have, on re-opening, exhibited the curious spectacle of native silver coating the wooden supports which had been left there. If metals, then, grow, as it were, under our own eyes, we cannot limit the extent to which nature may be productive, when we reflect that the periods of time which preceded human knowledge are immeasurable, and during which, her processes were always in action. It is perhaps, then, more reasonable to suppose, that the mineral and metallic contents of veins and cavities have been brought into their places by the agency of more than one cause.

Veins may have either mineral or metallic matter, or both, in them. They are found vertical, inclined, horizontal; often running in parallel courses, as if they had a cotemporaneous origin, and intersecting each other in such various ways, as to leave no doubt, that many of the intersected ones have been formed prior to those by which they are intersected. It is upon this last fact an opinion has been founded, that metals are of different ages. The principal veins in the English mines run nearly east and west. This is especially the case with the tin veins, or lodes, in Cornwall, as well as the lodes containing copper. The veins which run nearly north and south, are not as metalliferous as the others, which are intersected by them. Many of these, called *flucan* in Cornwall, are filled with clay. Clay is some-

times found in the copper veins, and as other metallic veins which deviate from the E. and W. course, contain increasing quantities of clay, and the flucan veins which run N. and S. are filled with clay, an opinion has obtained with many, that tin and copper are older metals than the rest, and that tin, for these reasons, and on account of its being found in granite, is the oldest of all the metals. If this priority of age in metals were true, it would be a fair subject for adventure in countries where tin has not yet been found—and that is the case in the U. S.—to work through a bad copper mine in order to convert it into a good tin one. With our present information, we do not see any positive proofs of priority of age in metals, especially from their presence in particular formations. When a vein is continuous through primary and secondary rocks, it is evident that these last had been deposited before the vein had penetrated the first. It is true, tin has not been found in secondary rocks; it is found, however, in slate, and therefore the circumstance of its being found in granite is not to be adduced as a proof of its priority of age; for the cases of its limitation to the granite may be accounted for, by supposing that the power which produced the fissure, only operated upon the granite. If metallic veins, in their origin, are analogous to trap dykes, or veins, then we see no limitation to the extent of tin veins, but in the nature of the superincumbent power which produced them, and in the absence of secondary rocks, to be affected by it. In the case of the great Cleveland dyke, we find the trap penetrating even through the coal beds; but tin, we believe, has not yet been found in rocks actually subjacent to the secondary rocks. We think this a sufficient reason why tin is usually found limited to granite and slate.

Pleased as we always are at seeing a new direction given to inquiries of this nature, yet we have thought that superfluous pains have been taken by European writers, to turn opinions from the igneous origin of metallic veins. The ancient Wernerian notion, that minerals and metals settled into fissures, from aqueous solution, has no friends among enlightened geologists of the present day: how their contents got exclusively into fissures, at great distances from each other, having a very irregular inclination, sometimes extremely dilated, then contracted into a very small space, and afterwards dilated again, resembling a number of blown bladders, connected by a long

wire; how they became alternately barren and productive, and why their contents are always found in these fissures, and never on the general surface, where, under such an origin we might have expected to find them, no man has yet ventured to say.

As to the theory of the igneous origin of the contents of many metallic veins, we see much to recommend in it, and we should have been surprised at the assertion of Mr. McCulloch, in his late work called a *System of Geology*,* that "the argument from the analogy of trap and granite veins is one of those superficial resemblances, consisting in words, rather than ideas, which it is painful to find in the writings of those who have been philosophers in other things," if we had not reason to suppose, from a rapid perusal we have now for the first time had an opportunity of giving that work, that the author was really and truly demented, *run a muck*, we may say, and at war with good sense, decency, and honesty, when he wrote it. We shall take an early opportunity of making good what we say.—That the contents of veins have been brought into their places by the agency of more than one cause, is very probable; but we know of no agency that recommends itself so plausibly as that of the igneous theory, for the origin of all compact metallic masses. We refer for striking instances of this, to the compact iron ore of Dannemora, in Sweden, which is one hundred and eighty feet thick, and to those extraordinary, and hitherto little known masses of crystalline iron, found in immense fissures, in the primary rocks of Franklin county, New York, and in some parts of New Jersey, all of which clearly indicate a subterranean and igneous origin. If masses of pure metallic iron can be thus produced from below, we know not why metals should not be brought, in like manner, into smaller fissures, or veins. Gold and silver are occasionally found in porphyry and sienite, which are volcanic rocks. Native copper is found in trap and porphyry. Lead and zinc have also been found in it. The elvan courses of Cornwall are porphyritic felspar, in which tin is diffused. It is true that earthy minerals are sometimes found associated with metallic masses having this origin; but infiltration takes place in all rocks, and especially in vesicular traps and amygdaloids. Those botroidal chalcedonies found in the copper lodes of Cornwall, are the produce of infiltration, from silicum in solution.

* Vol. I. p. 391.

Quartz also, in many instances; and we can witness the growth of calcareous spar as it gradually accretes from the roofs of calcareous caverns. We cannot imitate the forms, it is true, of many of the crystallized substances from mineral solutions; but it is because we are unable to conduct experiments which, perhaps, require thousands of ages of uninterrupted process.

It may be considered as giving weight to the igneous theory, that with few exceptions, the metals are found in the inferior rocks. In the immense deposits that lie above the coal beds we find, with the exception of ores of iron and a little copper slate, no segregation of metals into veins or masses resembling those in the inferior rocks. We find oxydes of iron in indurated masses, and in the state of bog ore, but these are clearly a rifaccimento from metals produced originally from the more ancient beds.

Perhaps, also, it is not true that all the metallic substances which have been brought into fissures from below, have arrived there in a molten state. Many of the substances found in them are capable of solution in hydrogen gas. Silver will deposit itself on substances suspended from the roofs of mines. Acicular crystals of lead are often found adhering to the walls of mines that have been closed a long time. The formation of saline matter on walls, and the spontaneous production of nitre on limestone, show that we are not yet acquainted with the principles upon which this branch of crystallization depends. We had occasion personally to observe, whilst on a visit to Mount St. Michael's in Cornwall, that on the sides of some masses of granite that had been separated from the rock for a great period of time, but which had evidently never been the wall of a fissure or vein, that amidst a profusion of small crystals of quartz, several hundreds of small white topazes were apparently forming. We were struck with the circumstance, and Sir John St. Aubyn kindly permitted us to bring some specimens away, together with any mineral substances we thought worthy our attention. The rocks there contain very curious minerals, but they are all contained, as the fine blue crystals of apatite are, in small veins. The topazes, on the contrary, were spread indiscriminately over the surface of immense fragments of granite, anciently separated from the mountain mass.

It would also appear as if some crystallized substances are the effect of a chemico-electric action between the wall, to which

they are attached, and the atmosphere, which standing in the relation of galvanic plates, decompose and re-compound the gaseous bodies which surround them. When glass is interposed between the wall and the atmosphere, the production of salt soon ceases. We cannot say that salt is suspended in the atmosphere, for dry frosty weather is favourable to the quick production of nitre. When a wall is coated with paint, crystallization still forms upon the paint.

Amidst the curious phenomena which metalliferous and other veins present, is the fact that their contents are modified on entering a different rock. The walls of veins change also with the change of beds. At Welhope, the walls are sulphate of barytes in passing through the sandstone, but on entering the limestone, they change to carbonate of barytes in balls, with a radiated diverging structure. It has been observed also that when mineral beds of a different character are so shifted that their faces are opposed to each other, that part of the veins is impoverished. This could hardly be, under the Wernerian theory, and may be more plausibly attributed to electric action. Veins usually have a sheath or case differing from the rocks they intersect. This mineral matter is sometimes mixed up with the metal contained in the vein; the sheath or case is called the walls of the vein, or gangue, or matrix. It is generally of a slaty structure, and in cases of igneous origin, may have been produced by cooling; the metal concentrating by affinity, and the slaty mineral remaining at the sides. At Castleton in Derbyshire, the vein of fluor spar, has a wall of cawk, or sulphate of barytes; the vein dilates into cavities, and again contracts into a small space, containing nothing but the cawk, which serves as a clue to the miner to conduct him to another repository of the fluor spar. Blende, a sulphuret of zinc, is occasionally abundant in Cornwall, in the upper part of veins that, lower down, become rich in copper. Tin also is found near the surface, with rich copper lying below. But in the mine of Cook's kitchen, after working first through tin, and then through copper to the depth of eleven hundred feet, tin is again found, and is still worked there to the depth of near thirteen hundred feet. The same vein at Dalcoath mine is sometimes contracted to six inches, and sometimes spread out to forty feet.

Trusting that we have said enough to draw the attention of

our readers to this interesting branch of geology, we must refer them to scientific works for further details, having a great deal to suggest on the direction of veins, and their intersection and consequent shifting, as well as to illustrate them under these circumstances, as they present themselves to miners, by some figures.

As a system of veins maintaining a general parallelism, is often intersected by another set apparently belonging to another system, it is to be inferred that the veins thus intersected and divided, preceded those which intersect them, as to time. It is also to be observed, that mineral veins are all either vertical or highly inclined, and that their lowest portions are generally the thickest; it is true that some appear to be horizontal, a fact which appears opposed to the inference that their source is from below, and which has induced many, who perceived the impossibility of their being produced by aqueous deposits, to suppose that they were all the results of crystallization. Horizontal veins, however, have, in such numerous cases, been discovered to be mere ramifications of larger ones that are either vertical or highly inclined, that those whose horizontal direction cannot be traced to them, may nevertheless be referred for their origin to an inferior source; and there can be no reasonable doubt that it would be found to be so, if their roots could be laid bare, which in many cases can only be by deep excavations; and the deeper we go, the less we find of this horizontality.

We shall stop to illustrate this subject by referring our readers to fig. 1, of plate xiii. where there is a very instructive view of a system of trap veins intruding into sandstone, on the east coast of Trotternish in the Isle of Sky in Scotland. Trap, it is true, occurs in such vast masses, and forms occasionally rocky districts of such great extent, that it may be thought by some not to be a proper subject for the illustration of what are strictly mineral veins. The consideration of trap rocks, it is true, belongs to a different branch of the subject, but we consider that no truth is more universally acknowledged in geology, than that volcanic lavas, ancient traps, with other intrusive rocks, and many of the veins of which we are now treating, are all the result of the expansive power which is eternally striving in the central parts of the earth, and that the phenomena of mineral veins may be truly illustrated by trap veins.

In this interesting section of Trotternish, which is taken from

McCulloch's Western Islands, it will be observed, that the horizontal trap veins represent the handle and triple prongs of a fork; and that if all that part of the section to the left, from where the handle is joined to the prongs, had been disintegrated and worn away in the lapse of time, leaving the part to the right representing the prongs; or if the same part of the section had been so covered up with other mineral matter, as to defy examination, the part exposed would have constituted a very puzzling case of horizontal trap veins; but we can here trace the prongs to the handle, and the handle to a huge vertical dyke of trap that has its undoubted origin from below: there is also a smaller vertical shaft rising in the handle, and three ramifications which the handle appears to have given out.

Figure 2, plate xiii. is a section of Loch Eyshort, also in the Isle of Sky. Here the trap, for a great extent, like the palisadoes on the Hudson river, the rocks near New Haven, and those at the Passaic in New Jersey, spreads in extensive masses over the surface of the ground; and according to the old Wernerian opinions, was deposited from aqueous solutions. In this section, however, we have a satisfactory view of the origin of this trap, which every locality does not give; for we see the roots of the trap, and have no room left for doubt that its origin is from below. Fig. 3, plate xiii. is another instructive section, representing the intrusion of a vein. Here we perceive how the expansive force from below, has raised the strata on each side; and how the fissure or vein which divides the two masses, contains various fragments of them, embedded near its edges. These jets of trap which have been thrown up from below, have obtained the name of dykes in England, and are, in some instances, remarkable for their great extent, and for the number of beds which they intersect. The celebrated Cleveland Dyke, of which we have spoken at page 343, (see April No.) extends about a hundred miles in the northern counties of England. At Preston quarry on the Tees, it comes up through the new red sandstone; at a quarry at Langburgh it cuts through the Lias, and at Bolam quarry, it not only comes up through the coal measures, but overflows the surface, as is represented by fig. 4, plate xiii.

We have shown, at page 311, the perfect agreement between the mineral constituents of modern lava, trap, and greenstone, one of the primary rocks; with such a strong indication of their

common origin, we need not be surprised at finding any of the primary rocks in the character of intrusive rocks, among those which lie above them in the geological series. Granite, frequently occurs intrusively. Masses of granite are often found intersected by veins of granite differing from them somewhat in their constituent parts. Gneiss and the slates lying above it are in like manner intersected by veins of granite. Figures 5 and 6, plate xiii. represent the granite traversing gneiss in the Vallée de Vallorsine in Switzerland. In various parts of the world streams of lava have been poured out from beneath the granite; the ancient volcanoes of Central France rest upon a granite plain sixteen hundred feet above the level of the river Allier, and their lavas, which have flowed since the valleys were formed into which they have run, pass into the state of compact basalt. Among other proofs of a common origin for all these intrusive rocks, whether lavas or traps, is that shown by Mr. McCulloch of a trap vein traversing granite, in the Isle of Arran, as described in fig. 7, plate xiii.

Where an evident displacement of rocks is observable, it generally occurs that some evidence of the cause is not very far off. In fig. 3, we see the strata displaced and raised, and infer that the displacement has been occasioned by an expansive subterranean force, of which the dividing trap vein is the evidence, the fissure in which it is contained being a sort of safety valve. At fig. 8, plate xiii. we have another instance of this subterranean force. The striped laminæ of the gneiss rock, and their continuation interrupted, that part lying to the left being raised above the part to the right. The fissure occasioned by this displacement, or shifting, is, in this instance, filled with a vein of granite. This occurs in Coll, one of the western islands. Fig 9, from Fudia, is still more instructive: the laminæ of the gneiss are here shifted as in fig. 8. A vein of granite which had intersected the gneiss, appears to have been in its turn shifted, by the subsequent intersection of a vein of quartz. On the other side of this mass of gneiss, another vein of granite intersects it, and is in its turn intersected by a vein of trap. From all these appearances, we may suppose that the veins of granite, and perhaps the trap vein, had penetrated the gneiss, perhaps before it had taken its indurated state, and that, at some epoch after every thing had become hard, the shifting took place, and the

vein of quartz filled the fissure occasioned by it. It is by applying reasoning of this kind to veniferous rocks, that we come at length to apprehend clearly that there are many systems of veins, and that some are posterior to others.

This branch of geology may become of the greatest importance in mining operations, and practical miners have always, more or less, been guided by the indications belonging to it. All the valuable metals with which we are acquainted, are connected with rocks having veniferous systems: gold and silver may be said to be uniformly contained within veins, or enlarged masses which derive their origin from below. It will probably become the general opinion ere long, that metalliferous masses have the same origin; and although bog ore of iron, and many other deposits of iron ore, may be considered as oxides more or less indurated, and brought into their present places by aqueous deposit, yet they are oxides from masses which had a subterranean origin. There are many ancient ferruginous sand formations, which were once, no doubt, in the state of recent bog ore, just as many conglomerates were once in the state of gravel.

We intend to resume this subject when we give an account of the gold region in the southern states. The phenomena we have been treating of will be applicable to the appearances which miners there are now becoming familiar with.

ON THE MODUS OPERANDI OF PHOSPHORUS ON THE LIVING SYSTEM

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Dear Sir,—The perusal of an interesting paper in your Journal for March, by Dr. Harlan, of "Experiments with Phosphorus on a Cat," has induced me to offer you some observations respecting the modus operandi of phosphorus, on the living system; and which, should you deem them deserving of notice, are altogether at your disposal. They are, to a certain extent, the outlines of my lectures on this subject, which I have, for the last three or four years, delivered to my class. I think the total insufficiency of the explanations hitherto given of the action of this extraordinary substance, both as a remedial and as a noxious agent, has been a principal cause of its depreciation, by rendering

practitioners fearful of its employment; when, if that action be fully comprehended, it will probably be found to be one of the most powerful and most prompt of all our stimulating remedies.

Without supposing the ideas I shall advance upon this subject are entirely correct, or even absolutely novel; I nevertheless consider them deserving of attention; since, if properly matured by the experience of others, they will unquestionably present to the hand of the physician, one of the most energetic remedies that has ever been employed.

I commence my remarks, by *denying in toto*, the poisonous properties that have been ascribed to phosphorus, by every writer on the subject, whether given on his own, or the authority of others. It is probably sufficiently known, that it has been chiefly administered as a powerful stimulant or tonic, by those physicians who have employed it, in certain chronic diseases; epilepsy, palsy, chorea, &c. and in various adynamic and ataxic fevers. The danger of its administration has been properly dwelt upon; and various supposed improved formulæ have been proposed, for its safer internal use; and yet, none of these circumstances appear to have led to a proper appreciation of its modus operandi, or of what is demanded, to render it safe and efficacious.

Not intending this as a medical communication, in its strict and proper acceptation, I shall say nothing of the diseases in which it has been recommended and employed: nor shall I meddle with its chemical history, further than is requisite to render intelligible and probable, that theory of its operation, which, to me, appears the only one capable of being sustained, both by argument and fact.

It is well known that phosphorus is considered as a simple body. To us, it is so, since it has never been decomposed. If this is so far correct, we have the analogy of almost every other so called simple body, of its being, like them, inactive and inoperative; until, by the chemical affinities existing between it and other agents, a change ensues in its character, which gives it a dangerous and destructive power, that it was not previously possessed of.

The co-operation of two other agents is essentially requisite to produce this change; neither, singly, is sufficient; nor even both united, unless favoured by existing circumstances. These agents are caloric and oxygen. Caloric alone, will fuse or melt

the phosphorus, but effectuates no change of property: and oxygen, at a temperature less than 50°, scarcely evinces any disposition to combine with it. Thus, phosphorus may be melted *under water*, at about the 120th degree of Fahrenheit's thermometer, and in that state and situation may be safely handled, because the accession of oxygen is prevented; but should the hand that held it, be raised above the surface of the water, at that temperature, each one knows what would instantly ensue; a rapid and vivid combustion, together with the contemporaneous formation of phosphoric acid.

Here, then, we perceive the train of events that gives to phosphorus, both its remedial, and its noxious character. Chemical in its action altogether, it depends on the accession of combustion, to give it activity. This combustion is, however, of a twofold description; one slow and feeble, with but slight disengagement of caloric and light, and productive of phosph*orous* acid; the other is rapid, as above mentioned, and phosph*oric* acid is the result therefrom. In the former case, a lambent, phosphorescent flame, may be presumed to stimulate the living fibres, without destroying them. In the latter, whether on the surface of the body, or in the cavity of the stomach, a *burn* of no trifling character ensues; for it is augmented in its violence, by the affusion or infiltration of the acid formed. The extent of the lesion will depend, of course, on the amount of the respective agents in their combination; but it must, whether large or small, be greatly modified from its character of a common burn, by the presence of the powerful acid produced by the combustion; which cannot but give it a different character, from that produced by caloric alone. As the extent of injury will therefore depend greatly on the amount of phosphorus inflamed, and of acid produced thereby, so that amount must also depend on the temperature, and on the quantum of oxygen present. The animal temperature being that of 98°, may be presumed to be partially augmented, by the motion of the stomach; and if combustion once ensues, it must unavoidably continue until the oxygen is fully expended. But, however small the burn, can this exquisitely sensible organ be wounded in the slightest degree, without deeply feeling its influence, and extending that influence to every part, through the agency of its numerous nervous fibrillæ? And will not that be greatly augmented by the irritation

of the acid formed? No poison, however, exists: every symptom, and the circumstances of the death ensuing, together with the *post mortem* appearances, all more obviously indicate the result of fire, than of any substance to which the appellation of poison can be strictly given.

If, then, when given as a medicine, how does it act? Unquestionably in a similar manner, although inferior in degree. The amount is small; the division of the phosphorus itself so minute, that it may, by its diffusion over the whole interior of the stomach, instead of being concentrated in one spot, be conceived of, as acting the part of a mild but extensive rubifacient, and thereby promoting that beneficial influence, that we might reasonably anticipate, from an appropriate and judicious administration. That it has occasionally proved fatal, even in small doses, cannot be denied: but without a full knowledge of existing circumstances, we must be unable to afford an explanation of the fact. If in a solid form, although small in amount, it might have ignited, and have produced all the effects resulting from a burn. Gastritis, and its results, increased by the acid formed, would probably be excited; whilst the more obvious effects of fire could only be appreciated, by a larger amount.

Let us advert now, to the case recorded by Dr. Harlan. Eleven grains were given to a cat at 10 A. M. of Tuesday, which seem to have caused but trifling uneasiness for several hours: nor did death ensue until Friday at one o'clock, or more than three days after its administration. The mucous coat of the stomach was generally inflamed, particularly about the great curvature, and pyloric portion, which displayed *numerous holes*, or abrasions, some of them much larger than the pieces of phosphorus swallowed. Two or three spots were sphacelated, the mucous coat near the pylorus softened in its structure, and this coat was also highly inflamed, and preternaturally softened throughout the duodenum; the same appearances extended the whole length of the intestinal canal. No remains of the phosphorus were found, the doctor supposing it to have been dissolved by the gastric juice; but which, I think, can scarcely have been the case, since Orfila found it to be insoluble in albumen, gelatine, milk, or bile, at the common ordinary temperature.

The above results, are the primary effects of the phosphorus on the stomach and intestines; the symptoms subsequently en-

suing, were of a secondary character, arising out of the gastric and intestinal injury, and need not be pursued at present; since they are not to be anticipated from the prudent and judicious employment of the article, when administered as a remedy.

The experiments of Orfila, related in the first volume of his Toxicology, very nearly agree in their results, with those of the experiments described by Dr. Harlan. I shall notice but one or two of them, previously remarking, that Orfila appears to ascribe the injury of the stomach, rather to *the acid* formed, than to the preceding combustion: for he says, that "it gives rise to these symptoms, by combining with the oxygen of the air contained in the alimentary canal, and gives birth to phosphorous, and probably to phosphoric acid, *in such manner, that the corrosion depends upon the action of these acids;*" and that "whenever it is introduced in cylinders, phosphorous acid is constantly formed, *which corrodes the portions of the membranes with which it comes in contact;* and that hence, the inflammation ought to be greatest, where the greatest possible quantity of phosphorous acid is formed;" that is, in the stomach and superior intestines, where the greatest amount of oxygen exists.

That he should ascribe so much to the acid, surprises me; seeing, that when speaking of the action of phosphoric acid itself (p. 369) upon the animal economy, he tells us, that when a *few grains* of phosphoric acid, dissolved in a *very small quantity* of water, are injected into the veins, the blood becomes coagulated, and the animal dies in the course of one or two minutes; but that if the acid *be weakened*, it does not produce any inconvenience: and that introduced into the stomach, it destroys life at the end of a variable space of time, *according to its concentration and dose.* In the experiment connected with this, he accordingly gave to a small dog, *thirty grains* of phosphoric acid, in a drachm of water; which, after some considerable suffering, caused his death, but not until after twenty-three hours. On dissection, the mucous membrane of the stomach, and the interior of the duodenum, were found of *a deep red.* It does not, however, appear, that any evidence existed of *the destruction* of those coats, as he invariably found, on giving the phosphorus itself. Now, if thirty grains of acid produced results so slow, and comparatively trifling, it is unreasonable to suppose, that the amount of acid from one or two grains of phosphorus taken, could be

productive of the fatal issue, sometimes following its administration.

In one of his experiments, he gave a small dog, one hundred and forty grains of phosphorus, divided into fourteen small cylinders; the animal having eaten nothing *for thirty hours.* He seems not to have suffered very greatly, and did not die until after twenty-one hours.

On dissection, the mucous membrane of the stomach was strongly inflamed, and covered with a stringy and flaky matter, easily detached. The muscular coat was of a bright red through a part of its extent. The mucous membrane of the duodenum, jejunum, and first half of the ileon, of a purple red colour, and covered by a thick fluid as black as ink. No phosphorus appeared in any of the parts above named; but the *lower half* of the ileon exhibited ten nodes at variable distances, containing ten cylinders of phosphorus of a reddish colour, and ninety-four grains in weight;—diffusing a tolerably copious smoke on opening the intestine: the mucous membrane corresponding to the places where they were found, *were much less red* than the parts already passed through. Three other nodes were found at the inferior portion of the colon, containing three small cylinders weighing twenty-six grains, and the muscular membrane here was still less red than of the ileon; the fourteenth cylinder was found in the rectum, weighing seven grains, and the internal coats were in a natural state. Thirteen grains then, of phosphorus, of one hundred and forty grains, had been removed, or disappeared, which is about the eleventh part; in which we find a curious coincidence with the experiment of Dr. Harlan. Of eleven grains, employed by him, the *whole* had disappeared, and inflammation extended even further than in the experiments of Orfila; we may reasonably suppose, therefore, that had more been given, at least two grains more might have disappeared; which being the amount that Orfila mentions as lost in his case, may possibly give us, pretty nearly, the quantum that, under common circumstances, might be converted into phosphorous, or phosphoric acid, by the oxygen it might meet with. Now, if this be the case, it would require but a little calculation to enable any one to *previously* decompose or drive out the atmospheric oxygen from the stomach and intestines; and then, thirteen or one hundred and thirty grains might be swallowed with impunity.

It is only the *first* step that is hazardous, *ce n'est que le premier pas qui coute.*

In another experiment of Orfila, he gave a middling sized dog one drachm of phosphorus, cut into eight pieces. He suffered but little, and did not die until the third day. He *had fed heartily two hours before* the phosphorus was administered. In this case, the mucous membrane of the stomach was of a *purple red* throughout; that of the duodenum and jejunum likewise *exceedingly red;* and but little alteration in the other intestines. The cylinders of phosphorus, reduced in bulk, were found in the colon and rectum. In this case we obviously perceive the influence of a full stomach in restraining the action of the phosphorus upon its coats, especially as administered in the massive state. This is confirmed by a subsequent observation of Orfila, who tells us, that frequently the phosphorus had not acted on the texture of the stomach *several hours* after its ingestion. I gave, says he, to an animal a *very great quantity* of food, and immediately after, two drachms of phosphorus, cut into twenty small cylinders. At the expiration of eight hours, he had suffered no inconvenience. I opened him, and found the phosphorus enveloped in the food, the texture of the stomach exhibiting *not the smallest trace* of injury.

Now, when much divided, it is more likely to come in contact with the stomach, and produce injury, if oxygen is present. Thus when he gave twenty-four grains dissolved (quere, if completely so) in three drachms of olive oil, to a small but strong dog, excessive suffering followed, even in one minute, and he died in horrible tortures in four hours and a half. The stomach was empty, *perforated with three holes* in its cardiac extremity. Two of them as broad as a shilling, the other ten lines in diameter: the mucous membrane that was not thus perforated, was reduced to a stringy pulp; and the muscular coat presented large ulcerations.

The tenor of all the observations, both of Dr. Harlan and of Orfila, is conclusive, I apprehend, in negativing the idea of phosphorus acting as a poison. And they equally prove its innoxious character, when oxygen is wanting to maintain its combustion, even at the temperature of nearly 100°. The safety of phosphoric acid is established (in proper amount) by the experiments of Orfila, as well as by its administration, *per se*, by many persons, remedially.—And hence, the disastrous, as

well as beneficial influence of phosphorus, must, I imagine, be explained on principles very different from those that have been usually adopted.

Although Orfila has not remarked the influence of phosphorus on the urinary organs, yet it has been noticed by Dr. Harlan, and by other writers. It is probable, that as the kidneys are the common emunctory of saline matter from the system, that the phosphoric acid formed, is absorbed by the lacteals, and being conveyed into the blood, is immediately secreted and carried off with the urine, stimulating, by its presence, the kidneys to increased action, and thus giving rise to its greater discharge.

That Mr. Chaubert has any antidote to the *poisonous* influence of phosphorus, I cannot believe; because, I think I have sufficiently proved that it possesses no such character. If then, no mountebank slight of hand should actually deceive the senses, it would follow, that any measure adopted by him must be one that precludes the *co-existence* of those agencies in the stomach, to which I have adverted; and without which co-existence, phosphorus is altogether harmless. Let us then try to point out a few particulars, by which such co-operation may be prevented: perhaps others may suggest themselves to my readers.

1. By copiously filling the stomach with food, previously to swallowing the phosphorus, which is thereby enveloped; and, at the same time, but a very minute portion of any oxygen present can come in contact with it—the chances, therefore, of even the lowest degree of combustion taking place, are very trifling; the phosphorus passing on, and is discharged, without coming in contact with the parietes of the viscera.

2. By previously swallowing some *carbonat* of magnesia, or of potash, or soda; and *washing down* the phosphorus with *some weak acidulated* drink, as of sulphuric acid, or even acetic acid; which, coming in contact with the carbonat, produces an evolution of carbonic acid gas, in which phosphorus cannot burn. It may indeed happen, that in the slow or rapid combustion that might ensue, the evolution, or formation of the phosphorous, or phosphoric acid, would supply the place of the before-mentioned acids—and acting on the carbonat, equally evolve the carbonic acid gas, by which the combustion might be suspended, and further danger prevented:—the compound formed, subserving

the purpose of expediting the phosphorus and other contents through the alimentary canal.

3. Even largely filling the stomach with simple water must be adequate to prevent combustion; for any oxygen present would seek the higher part of the cavity of this viscus, whilst the phosphorus would as certainly fall to the lower part. By this simple measure alone, of largely drinking, Mr. Le Roy prevented the injury he would have otherwise probably received from three grains of phosphorus, which he took at once.

4. Phosphorus has the power of decomposing some metallic salts, as sulphat, or nitrat of copper, &c. and of causing a perfect precipitate of metallic copper to invest it, and hermetically seal it from the action of the air, if any should be present. If then, a weak solution of either of these salts, or perhaps of others, should be previously swallowed, and vomiting not produced thereby, the phosphorus would soon be invested with a sheathing of copper, altogether harmless to the stomach.

Now, whether any of these, or similar measures be adopted, they will all be found to act by simply restraining, or preventing the agencies of chemical affinity; but in no wise acting as antidotes, in the proper meaning of the word. It must be obvious to every one conversant with the laws of chemistry, that the danger of phosphorus on the animal economy, can alone be obviated by such measures as are capable of preventing those laws from taking place in the stomach.

The best mode of administering phosphorus, as a remedial agent, must then, apparently, be that in which all hazard of a vivid combustion might be prevented, and yet the stimulating agency of caloric be extensively diffused in a small compass. This seems best accomplished by the ethereal solution of phosphorus, of eight grains to the ounce, or one grain to the drachm. The dose of six to ten drops of this solution will thus convey into the stomach from the tenth to the sixth part of a grain of phosphorus; to every part of which the ether evaporating, conveys an infinitely small proportion of this active substance, which, like a diffusible stimulant, or *rubefacient*, is prompt in its effect, whilst it is free from danger. No actual combustion ensues; it rather resembles the genial warmth of a gentle flame; whilst the injurious effects of an absolute burn, accompanied necessarily with local destruction, is prevented; and the acid produced,

whether phosphorous or phosphoric, is probably, under such circumstances, itself a beneficial tonic to the system in all such cases as it may be judged proper to employ it.

These views, if correct, may probably lead to the renewed employment of a remedy, which was at one time enthusiastically extolled, but soon fell into discredit. Its danger, under correct views of its action, can scarcely be dreaded; and, at all events, it seems proper to establish the real character it ought to maintain, which can only be effected by accurate and adequate experience. And should these views even be found erroneous, they may possibly lead to others more correct, and which must necessarily subserve the interests of science and of humanity.—I am, very respectfully, your obedient servant

JOHN REDMAN COXE.

OBSERVATIONS ON THE ANATOMY OF THE SLOTH;

(BRADYPUS *tridactylus*, Linn.) by R. HARLAN, M. D.

I HAVE been indebted to the Academy of Natural Sciences of Philadelphia, for the long desired opportunity of making a dissection of this most curious animal. The specimen was preserved in spirits, and was sent along with many other interesting quadrupeds, by Dr. Hering, from South America. The specimen is one of the common variety of the Bradypus tridactylus of Linneus, and proved to be pregnant with a fœtus, nearly matured. For the knowledge which we already possess of the anatomy of this animal, we are principally indebted to the observations of Daubenton and Cuvier;—my own dissection has resulted in the discovery of several additional facts, as well as the detection of some errors.

As regards the habits of this animal, in a state of nature, the accounts of travellers are at variance with each other, and the subject still remains obscured in fable. The Sloth has generally been described as one of the most miserable, helpless, and dejected of beings, the effect of a physical organization altogether extraordinary and imperfect. A recent English traveller, however, Mr. Waterton, who has observed these animals in a state of nature, represents them as sufficiently active in their proper element, *on trees*, and asserts that they pass from bough to bough, and from tree to tree, with a rapidity which soon enables them

to lose themselves in the depths of the forests. However this may be, there can exist little doubt but that most of the errors in the description of their habits, and the false inferences drawn from what appears at first view a vicious organization, are to be attributed to the erroneous notions which prevail, relative to the true position of this animal in the scheme of nature, and the part which it was intended to perform.

Considered as a creature destined to pass nine tenths of its existence on the trees of the deep-foliaged and endless forests of the tropical climates, where it lives, breeds, moves, and has its being; we venture to assert, that no other animal is so perfectly adapted, by its peculiar organization, to such a mode of life. But, on the other hand, viewed as a quadruped, formed for progression on the ground, or on a flat surface, it must be confessed, that the construction of its osseous frame, presents us with an anomaly in nature unequalled; an enigma insusceptible of solution; a machine, monstrous in all its proportions, without apparent form, utility or intention. But of such an anomaly, the whole creation does not furnish us with a single example to interrupt that series of animated beings, where so much beauty and order of arrangement are displayed, from the "worm that revels in the dead man's socket," to the "lord of the lion heart and eagle eye." All are equally perfected, and wonderfully adapted to fulfil the purposes of their existence.

To commence with the skeleton of the individual before us, it is necessary to premise, that though it was nearly full grown, all the parts are not completely ossified; hence it may be inferred, that such portions as are completely solid in this subject, will always be found so in all adult individuals, and some other portions that are here cartilaginous, would have become ossified by age. Referring to Baron Cuvier's description of the several skeletons of the Sloth which he has examined, it will be perceived that the same species differed among themselves in several important particulars. One of his specimens possessed 16 ribs, of which 7 are false. Another, a younger subject, possessed 14 ribs, of which 5 are false: (vid. Ossem. Foss. vol. v. pt. I. p. 81.) Our specimen possesses 15 ribs, 6 of which are false. The Baron represents the *Ai* with 3 lumbar vertebra: ours possesses 4: the former has 11 caudal vertebra: the latter 10: the former 6 false vertebra of the sacrum: the latter 5.

These discrepancies will appear more evident, being placed in a tabular form. In the first column we have arranged Cuvier's adult specimen, in the second our own.

	Cuvier.	
Cervical vertebra	9	9
Dorsal	15	16
Lumbar	3	4
Sacral	6	5
Caudal	11	10
	45	43

The transverse processes of the first caudal vertebra, are elongated, and flattened or depressed, and are united to the os ischium by cartilaginous suture, which tends very much to enlarge the capacity of the pelvis, the outlet of which is disproportionably large: the posterior, or sacral region, presents a very broad, nearly flat, and solid surface, for the pregnant uterus to rest upon, as well as to accommodate the enormous rectum, in the usual position of the animal; that is, suspended from the lower surface of the limbs of trees, the back towards the earth: by this form of the pelvis, the cotyloid cavities, and consequently the thigh bones are widely separated, rendering an approximation of the knees difficult; an arrangement, which though exceedingly inconvenient to a quadruped walking on the ground, is, at the same time, an admirable structure for an animal always embracing a trunk, limb, or some foreign body, between his thighs. The ossa pubis are separated more than an inch, by an intervening cartilage in the present instance, which was ossified in Cuvier's specimen; whilst the sacro-ischiatic ligaments, uniting the sacrum to the ischium at the suture between the tuber ischii and transverse processes of the first caudal vertebra, are already ossified. The sternum is composed of nine distinct pieces; its nine cartilages are all ossified, and united to the true ribs and sternum by cartilaginous suture: the ninth cervical vertebra supported at the extremity of the transverse process, an osseous rudiment of a rib, to which it is joined by cartilage: the unusually long neck of this animal, was exceedingly flexible, particularly so in the anterior direction, forming very readily a complete circle, with the snout resting on the ninth vertebra. This long and flexible neck, bending in every

direction, must offer considerable conveniences to an animal which feeds on the leaves of trees in its immediate vicinity, and would also enable the animal to direct his visual organs to any position, without changing that of its body.

But the most remarkable peculiarity in the skeleton of this species, and which alone distinguishes it from that of all others, and admirably adapts it for its characteristic mode of locomotion, is to be observed in the form, structure, and articulation of its posterior extremities. We have already alluded to the widely separated state of the thighs at the acetabulum, which enables it the more readily to embrace any foreign object; the knee-joint is large, strong, and flexible; the femur is long, stout, and depressed, with a considerable concavity on its inner edge; the bones of the legs are both convex externally, all admitting of the attachment of powerful muscles, and the joints, though supplied with firm ligaments, are unusually flexible. Baron Cuvier has already dwelt with great interest, on the very extraordinary and unique manner in which the foot is articulated with the tibia and fibula; the astragalus, in addition to the pulley-like surface, by which it moves on the end of the tibia, presents, on its exterior and upper surface, a deep conical pit, which receives a corresponding projecting bone of the inferior head of the fibula, admitting the greatest latitude of rotatory motion, together with the usual ginglymus motion of the ankle, at the same time rendering dislocation impossible; but the powerful lateral ligaments prevent lateral motion at this joint; this, however, is more than compensated, by the unusual degree of motion existing between the calcis and astragalus, or rather of the latter *on* the former bone; producing a rocking motion from side to side, two distinct transverse pulley-like surfaces on the inferior aspect of the astragalus, being received into two corresponding cavities in the upper surface of the calcis, and to render the joint more secure, the anterior articulating surface of the astragalus, presents a deep conical pit which receives a pyramidal process, projecting from the usual articulating surface of the cuboid bone: a complication of structure, attended with equally complicated motions, witnessed in no other quadruped, and utterly useless and inconvenient to an animal moving on a plane surface; yet admirably adapted to the habits of the Sloth, as it enables the animal, in any position of the body, to apply the

soles of its feet to the sides, or even opposite surface of the limb or trunk of the tree, on which it is climbing; its long claws and powerful muscles harmonizing with this arrangement, enable this animal to remain thus suspended, for hours and days without fatigue, and even to sleep, in a position so awkward and painful to other animals.

The organs of mastication, the peculiar construction of the shoulder, with many other interesting details, have been already fully commented upon by Cuvier, in his "*Ossemens fossiles:*" in the present instance, the rudimentary clavicles and coraco-acromion pieces were cartilaginous. We have only further to remark, as entering into the composition of the knee joint, the existence of a large sesamoid bone at the exterior portion of the head of the fibula; and that, in two crania which we possess of this animal, all the canine teeth are worn on their *posterior* surfaces.

The size of this species has been variously estimated, at from 14 to 28 inches in length; the skeleton of our specimen is 22 inches in a straight line from the tip of the snout to the extremity of the tail.

The following represent the measurements in detail:—

	Inches.	*Tenths.*
Length of the Head,	2	6
Neck,	4	6
Body,	9	0
Sacrum,	2	4
Tail,	3	4
	22	00

Length of the arm 7 inches 2 tenths: length of the fore arm 6 inches: length of the hand, including the wrist, 5 inches: greatest circumference of the body 13 inches.

The crowns of the molars appear peculiarly adapted to the mastication of leaves. The *fœtus in utero* possessed the same number of teeth, similarly arranged, and with the exception of being more conical towards the crown, presented perfect miniatures of those of the adult animal; and from the state of their developement, no doubt can exist of the capacity of these animals to masticate from the period of their birth. The fœtus was clothed with a profusion of hair, marked in every respect

like that of the adult; the eyes appeared to be perfectly developed: compared with other animals, the fœtus was unusually large; yet its protrusion is easily effected by means of the extremely large outlet of the pelvis, and the peculiar structure of the generative organs. The uterus is musculo-membranous, and contains two distinct lobulated placenta, one on either side of the fundus, receiving an equal number of branches from the umbilical vessels.

The reproductive organs of this animal are singularly anomalous. Vagina ab recto sejuncta est, ambo tamen uno ore aperiad untur, sphinctere communi circumdato; in ipso cujus introitu, inferiorem spiraculi partem apparent nymphæ bene patefactæ, et clitoris triangularis foliaceaque. Circiter mensuram unciæ intra vaginam, meatus urinarius se aperit. Inter vaginam et os sacrum latum, rectum ingens positum est, impletum induratis fæcibus, similibus excrementis ovis.

The Sloths, then, have been erroneously represented as possessing a cloaca like that of birds, inasmuch as there does not occur any mixture of the contents of the bladder and rectum, as is the case in true cloacæ. The vagina and rectum, or cloaca, are distinct from each other; there being no large intestines, properly so called, the rectum performs the functions of the coecum. Although the animal is strictly phytivorous, the bowels resemble those of the carnivora, being small and short; the inferior portions are somewhat succulated, like the colon; but the fæces do not assume their characteristic form, until they have reached the rectum. The stomach consists of a large paunch, in no way furnished with compartments like that of the ruminantia, as is asserted by Buffon, who also errs in attributing ruminating faculties to these animals; but this organ presents a structure differing from that of any other animal with which we are familiar, being furnished with numerous long, conical culde-sacs, some of which are divided longitudinally into two compartments; these, in the present instance, were filled with masticated leaves, of a pulpy consistence. The liver is small, without a gall bladder, or any unusual enlargements of the ductus communis. The kidneys are rather small and conglobate: the urinary bladder is very large. The heart was very small, and contracted by the spirits, as were all the blood vessels. The account given by Mr. Carlisle, of the peculiar distribution of the

humeral and femoral arteries in these animals, (vid. Philos. Trans. Lond. 1800,) had excited our curiosity, and prepared us for disappointment; for after the most careful examination of the arteries, we were unable to detect any resemblance to this *rete mirabile* structure, which was thought to explain the cause of the tardigrade movements of the Sloths; after considerable difficulty in distinguishing the nerves from the arteries, (the action of the spirits had rendered them similar in appearance,) we only succeeded in detecting and passing probes into the cavities of the humeral profundal, and the radial, ulnar, and interosseal branches at the elbow; but as the present specimen had been preserved in spirits, and Mr. Carlisle injected the arteries of his specimen, we are not authorized to question the observations of so accurate an observer, from the results of a single dissection. We wish, however, to direct the attention of comparative anatomists who may possess an opportunity, to a re-examination of this arterial arrangement.

It will be apparent, from what we have said, that the term Tardigrade, derived from the extreme slowness of this animal, does not express its principal character; that the peculiar organization of the Bradypus, and its prodigiously compressed and crooked nails, cause its locomotion upon the surface of the ground, to be very slow, is true; but if one animal existing under this negative condition, is to be called Tardigrade, we conceive that all animals under like restraint, and not belonging to the Edentata, may, with equal propriety, be put among the Tardigrades.

The mud-fish of the genus Hydrargira of Lacepede, are often, by the retreat of the tide, left on the shore. These animals have the faculty of springing up and changing their place; they will thus advance over a considerable space, until they gain the water, which is their proper element. In like manner, the Bradypus, by an imperfect motion when on the surface, gains the trees where it lives, feeds, and sleeps. It rarely leaves the tree it is on until it has stripped it of every leaf, so painful is the effort to change its situation, by dragging itself on its elbows from one tree to another when they stand far apart. The nails of this animal, when at rest, are always bent towards the palm of the hand; and it is thus it sleeps, grasping the branches, and suspended with its back towards the ground. We think the

term Pendentia would be even more appropriate than Tardigrade, for these mammalia.

ANCIENT VITRIFIED BEACON STATIONS.

To the Editor of the Monthly American Journal of Geology.

Sir,—Your readers, perhaps, are aware that there are in Scotland certain stations of an irregularly round or elliptical form, in somewhat elevated situations, surrounded by one or more stone walls, or ramparts, rudely put together, and without any regular masonry. These walls are constructed of fragments of primary rocks, granite, gneiss, mica-slate, and other feltspathic rocks. About half a century ago, these stations attracted a great deal of attention, from its being observed that the greater number of them had these walls partially, or altogether vitrified, or slagged together into a coherent mass, evidently by the action of fire. Many theories were brought forward to account for this unusual appearance. By some, the vitrification of these walls was attributed to volcanic agency, and the area which they surrounded was considered as a crater. Mr. Pennant, the naturalist, and other eminent persons, maintained this opinion. This, however, gave way to another, brought forward by Mr. Williams, a mineral surveyor, in 1777, who supposed them to have been ancient forts, or defences, and that the vitrification of the walls had been artificially produced, by laying the mineral materials upon beds of fuel, and firing it. Dr. Maculloch defended this theory in the Transactions of the Geological Society of London. In 1787, lord Woodhouselee proposed a new theory, in the Transactions of the Royal Soiciety of Edinburgh. He supposed these stations to have had a superstructure of wood built upon these walls, and that the vitrification was produced by the destruction of the timber by fire.

A more reasonable supposition than any of these was subsequently brought forward in that valuable work, the Statistical account of Scotland, a work of which too much cannot be said in praise, or of its public spirited and venerable projector, Sir John Sinclair, Bart. This was the opinion, that the vitrification of these walls was owing to the action of beacon fires, and that these stations were not ancient forts, but beacon sites, "gene-

rally situated on lofty insulated hills, in such a chain of mutual connection as to allow telegraphic communications to be conveyed from one station to another, at a considerable distance." The fused state of some of these walls had brought them within the province of geology at one time; but it is now perfectly clear that the consideration of these stations belongs purely to archæology, and any person who still entertains doubts on that subject, has only to read Dr. Hibbert's papers, contained in the October number for 1831, of Dr. Brewster's Journal; especially the letter to Dr. Brewster, entitled, "Notice of the discovery of very extensive vitrified remains at Elsness, in the Island of Sanday, Orkney," to be entirely convinced of this fact. This notice of a very interesting subject will be concluded by citing the following passages from the letter alluded to.

"Such is the general history of the vitrified cairns of Orkney, which may serve to set at rest, I trust for ever, two questions which have been agitated for more than half a century. The first is,—To what uses or observances is the effect of vitrification attributable? While the second is,—To what people is the effect attributable? In a tone of confidence, therefore, we are now entitled to reply,—That vitrification was merely incidental to the fires which were kindled upon beacon stations; and that the people who, in every country which they occupied or colonized, organized systems of beacon stations, were of Scandinavian origin."

The letter concludes with the following summary.

"*First:* That the vitrified sites of Orkney not being characterized, as in Scotland, by the presence of stone ramparts, but simply by small cairns, upon which the fuel for beacon fires had been placed, incontestibly show, that a beacon station was not of necessity a place of strength or defence.

"*Secondly:* That such of the ancient *Duns*, or strengths of Scotland proper, in which vitrification is found to be an occasional occurrence, belong to the oldest fortified sites in the country, and are referable to some of its oldest inhabitants, probably to the Picts, who are supposed to be of German origin.

"*Thirdly:* That these ancient Duns, not originally vitrified, indicate, by their construction and extent, that they were used by a people who had already passed from the hunting to the pastoral state; as they evidently comprehend in their design, the protection of cattle, with that of human defence.

"*Fourthly:* That from the tenth to the fourteenth century, a considerable part of Scotland was overrun by the Scandinavians, under the various names of Northmen and Danes, who reciprocally became themselves liable to invasions from other piratical tribes of the same northern origin as themselves, and were therefore induced to institute systems of beacon fires, in imitation of those with which they had been familiar in Norway.

"*Fifthly:* That as in most instances the ancient fortresses or duns of the oldest historical period of Scotland, were continued to be used as the gathering places of clans or tribes, the same were most conveniently selected as the sites of beacon

fires; the ramparts of loose stones, which characterize such fortified sites, serving the additional purpose of cairns on which such fuel was placed.

"And *sixthly:* That the intensity of fusion exhibited on the vitrified sites, is no less referable to the forest trees which, on such occurrences, extravagantly blazed, than to the incessant hostile invasions which caused beacon fires to be lighted. But while I state these, my *present* conclusions, (for it is possible I may yet make some little modification in them,) I would not renounce the idea, that other public occasions, as, for instance, the annual lighting up of the fire of the belting, might have assisted, though in a subordinate degree, towards producing the vitrified effects, which continue to be the astonishment of all who are conversant with their extent.

"But I must now conclude, as I have already exceeded the limits which I had at first assigned to it. The interest which continental geologists have begun to take in the varied effects of ignition which these vitrified sites display, has naturally made them curious regarding their mysterious history; which circumstance is the only apology I can offer for making your Journal, on this occasion, a medium of pure antiquarian inquiry. In some future number, I hope to render you acquainted with the mineralogical observations of M. Von Leonhard, on the specimens examined by him from the vitrified sites of Scotland." F.

RAFINESQUE'S ATLANTIC JOURNAL.

Enumeration and Account of some remarkable natural objects of the Cabinet of Professor Rafinesque, in Philadelphia; being Animals, Shells, Plants, and Fossils, collected by him in North America, between 1816 *and* 1831. *Philadelphia, November*, 1831.

Atlantic Journal, or Friend of Knowledge; a Cyclopedic Journal and Review of Universal Science and Knowledge; Historical, Natural, and Medical Arts and Sciences: Industry, Agriculture, Education, and every kind of useful Knowledge. With numerous figures. Editor, C. S. Rafinesque.

We had occasion, in our February number, to animadvert upon the injustice Professor Rafinesque had received, in relation to the bivalve shells of the river Ohio: we were led to this purely from a desire to strengthen the interests of natural science, by vindicating the claims of its votaries to fair dealing, and without any reference whatever to personal sympathies and antipathies. We again take up the pen in behalf of the interests of natural science, though we do not believe that upon the present occasion our remarks will divert Mr. Rafinesque as much as they will our general readers. In some branches of natural history, the active labours of this natural, historical, medical, and universal

person, have been usefully applied, and have been praised; and if he had not been so paradoxical, and so off from the perpendicular in his writings, his authority, in matters of natural history, would have had some weight. We have observed with regret, for a long time past, that the European naturalists have not given that credit to the professor, which, from the necessity of the case, and from courtesy, they always extend to those of their brethren whose respectability and veracity is undoubted. We have observed that *nobis* out of the professor's mint was not current; but we never thought the magical letters *Raf.* would find their par value so soon.

The two productions, whose titles we have placed at the head of our remarks, satisfactorily explain why this is so. The most malignant enemy could not have injured the professor as much as they inevitably must do; nothing but a rash presumption of a general ignorance, that would dishonour us all, and of the public inability to discover the worthlessness of such a farrago as he has now let loose upon us, could have encouraged him to produce, what is entirely beneath the dignity of criticism. Nevertheless, the reputation of the country abroad, and the satisfaction of the lovers of sound learning at home, require our interference, and we think this a fit occasion to enter upon that part of the duties alluded to in our prospectus, "to put down impostures and puerilities as they arise."

Let us first examine the "Enumeration," &c. where, in his 'Article 1, Fossil Remains of Quadrupeds," he has brought such strange names, strange things, and strange language together, that we are quite sure he has every thing to learn concerning geology and fossil remains.

And first, we have No. 1, *Mazama Salinaria*, of Rafinesque. A new genus, upon the authority of nothing but a piece of horn, five inches long, found in an old saline of the Indians, in Kentucky. The description concludes, "*it belongs to the latest geological age of fossil animals.*" The professor says it approximates to his genus Mazama, which yet exists in South America. What he means by the "latest geological age of fossil animals," we are utterly at a loss to comprehend under all these circumstances.

Next comes *Panallodon Tumularium* of Raf. which owes its existence to a jaw bone, six inches long, found in a *Solar tem-*

ple [*! ! !*] in Kentucky. He thinks this akin to mazama, which was somewhat similar to the antelopes, but having teeth, "more like some carnivorous animals, but no canine tooth," "*latest geological age, later than No.* 1, *period of the Mastodons.*" We were just told that *Mazama Salinaria* belonged to the "latest geological age," but panallodon it seems belongs to an age *later than the latest.* Whether the words "period of the mastodons" refer to the mazamaic or panallodontic period, we are left to guess. Hitherto we have been exceedingly puzzled to assign a geological period for the existence of the mastodon; but it is now settled, that *the mastodontic period was contemporaneous with that of a bit of horn five inches long, or with carnivorous antelopes.* Here is a stride in the history of extinct fossil animals!

After this we have No. 3, *Taurus gigas*, of Rafinesque, a "beautiful and perfect tooth of a bull," which, a few lines afterwards, is stated, "must have belonged to a very large ox." This animal, we are told, was of the "age of the mastodons." Here is a bull genus, established upon the strength of what no doubt is a recent buffalo's tooth, with which the western country abounds. There is something worse than puerility in this. Rafinesque knew that the genus bos was established for the receipt of all kinds of bovine remains, and that Dr. Harlan's species of bos latifrons was universally received, and to which his bovine tooth, if properly fossil, should have been referred. Rafinesque, who has bitterly complained of others for trespassing upon his grounds, shows here the budding forth of the same talent in himself, to more exquisite proofs of which we shall by and by come.

Among the fishes we have No. 6, *Nephrosteon;* but we shall cite the description, as a specimen of the Professor's style.

"No. 6, Nephrosteon, Raf. Very singular fossil bone of a fish from the *diluvial* regions of Louisiana. *It must have been the head-plate of a huge fish twenty feet long or more*, but I know of none with similar shields. It is a fine perfect flat bone, yellowish white, solid, hard and heavy, rounded, with a reniform base, eight inches broad and six and a half long; half an inch thick; edge entire, thick; surface above nearly smooth, with an areolar depression round the centre, which has several unequal chinks. Lower surface entirely covered with vermicular anastomosed elevations, forming irregular pits and prominences. *Is it the bony shield of the head of megasaurus? or some other fossil reptile?*"

Before we give Mr. Rafinesque an answer to his question, we must tell him that it is inexcusable in one, who pretends to write on geological matters, to commit so great a blunder as to call

the alluvial soil of Louisiana "diluvial;" and that he has been unlucky in not sticking to his first guess, that the bone belonged to a huge fish; if he had had the slightest knowledge of comparative anatomy, he would have seen, at first inspection, that this bone formed no part of the head of any animal, but was simply, what we venture to assure him it is, the Ephyphysis of the vertebra of the existing spermaceti whale, and which is of very common occurrence in the *great whales' burying ground*, of Louisiana.

This nephrosteontic affair is a pretty good specimen of what the Professor can do in the way of geology and comparative anatomy. One of the most insignificant osseous parts of a whale, and which only belongs to it whilst very young, is hocussed into the representative of a new genus of extinct animals, which, in one line, "must have been the head plate of a huge fish," and in the next produces the interrogation, "is it the bony shield of the head of megasaurus, or some other huge fossil reptile?" A buffaloe's tooth sits in his scientific parliament for *Taurus gigas*; and as to Mazama Salinaria, and Panallodon Tumularium, their most conspicuous character is, that one of them belongs to a geological period "later than the latest," though by the context it is impossible to find out which of the two enjoys that inestimable advantage.

As to the *Atlantic Journal*, we despair of doing justice to its various merits; it is a perfect museum of curiosities, and those who desire cheap amusement—for it only costs twenty-five cents—cannot do better than purchase it. Lest, however, it should prove too great a mystification to those who may feel disposed to purchase it upon our recommendation, we must tell the truth—for we have read it—and fairly state, that it belongs to the days of Dr. Katterfelto of famous memory, rather than to the present times, as a few extracts we are about to give will show. These we take from the cover of the book, where there are no fewer than twenty advertisements. Having never heard of this Atlantic Journal, we were not a little surprised to see, that the first number had already acquired so valuable an advertising custom. Upon examining them, we found them all, without a single exception, drawn up by the Professor himself, and trumpeting forth his own praises and opinions, with as experienced and firm a blast as ever was in the service of the best pa-

tent blacking. Of this work the professor says in his introduction, "It will be of a strikingly novel character, and must be left to speak for itself; to deserve, by its own intrinsic value and merit, the patronage which it claims from all the friends of knowledge, education, and learning." We shall now treat the friends of knowledge, education, and learning, with the promised extracts.

"This Journal will be sent to several distinguished individuals."—"All those who shall keep it, will be put on the subscription list, and they are requested to pay the account to our agents, of which a list shall be given in our second number: unless they subscribe for the whole first volume, and remit us direct two dollars."

Hence we infer that the "distinguished individuals" who have been thus favoured, will be made to pay *one* dollar, unless they prefer the accommodating alternative of paying *two*.

One of his advertisements on the cover is addressed to "European readers," and announces that he has appointed *three* agents in London, and *four* in Paris: then comes an advertisement *for a paper-maker, one for a printer*, and *another for a publisher*. The following is a fine specimen of the encouragement he has to offer to them:—

"WANTED.—Two travelling agents to procure subscriptions, sell books, and collect money. None need apply but such as can give undoubted security. Apply at the office of the Atlantic Journal."

But the following advertisement settles for ever the genus to which Professor Rafinesque belongs:

"MEDICAL SPECIFIC FOR THE CONSUMPTION.—A safe and efficient remedy for this fatal disease, has been discovered by an *eminent* Botanist and Pulmist of Philadelphia, Professor of Medical Botany, &c. It has effected several wonderful cures, and already cured or relieved seven hundred persons from Boston to New Orleans. *It is a mild, fragrant and palatable remedy, purely vegetable*, which some patients become quite fond of; it is calculated for this disease only, but susceptible of many preparations and modifications to suit (and apply to) all the various cases. It is called the PULMEL; with it are prepared a Syrup for common use, and a Balsam for inhalation. A Pamphlet on the Pulmel is given gratis. A work called the *Pulmist*, or *Art to Cure the Consumption*, has been published as a guide. Dr. RAFINESQUE, the proprietor, practices exclusively as a Pulmist in diseases of the lungs, and is very successful. He sends ample consultations on specific cases to any part of the United States, and has thus cured many at a distance. Consultation alone $10, with the work and all the Pulmel needful for a complete cure $25, will be sent any where on demand, and a remittance."

Of the contents of this work, and of the pity they will excite in all, and indignation in many—pity, for himself, and indignation at this wanton attempt to disgrace the cause of knowledge,

we shall merely say, that of zoology there is nothing which has not been published before. The geological portion shows an entire ignorance of even the outlines of the science. *The tabular view of the American generic languages, and original nations*, is drawn from that insane mass called *The Annals of Kentucky*. The article entitled *The Atlantic Nations of America*, is upon a par with it. He gives tables of words of different languages, to show their affinity, where not the slightest analogy between the words can be traced by any effort of philological refinement. It is enough to unsettle a weak mind to examine the crazy assertions he is constantly making, and which he puts forth with the greatest confidence.

The professor's "History of China before the Flood," is a morceau every way worthy of himself. His facts and reasonings are in perfect harmony with the figures and perspective on the old porcelain of the celestial empire, these last standing in the same relation to nature that the first do to history. We give the following inimitable extract from page 25 of the Atlantic Journal. From the four concluding words, we suspect it forms part of an edict which the Son of Heaven has addressed to the professor.

"The state of mankind before the flood of Ynti (or Noah, which agrees in time with the seventy computation) is represented as happy. China, called *Tien-hia* or Celestial Region, (universe) was ruled by benevolent monarchs, who took nothing and gave much; all the world submitted to their virtues and good laws. They wore no crown, but long hair; never made war and put no one to death. Harmony even reigned between men and animals; men lived on roots, fruits and cattle; they did not follow hunting, property was in common, and universal concord prevailed. They did not therefore deserve the punishment of total destruction by a flood.

"This interesting and important part of the early history of mankind, is not yet inserted in the would-be universal histories of the western Barbarians, as the Chinese call us. Our compilers for ages appear intent on destroying the little remnant of ancient historical knowledge as yet extant. *Let it be revived!*"

We think we can now perceive the reason why Mr. Rafinesque's authority as a naturalist has been hitherto considered so unsatisfactory. Those who accuse others of encroaching upon their rights, are especially bound to act with uprightness themselves. Mr. Rafinesque will admit, that if, upon a previous occasion, we were not slow to vindicate his claims to justice, we ought to be equally prompt in asserting the rights of men of

known intelligence, and who are eminent for their disinterested labours in the cause of natural science.

At page 20 of the Atlantic Journal, is the following passage, in a letter which he states to have written to Baron Cuvier.

"I send you, as you request, the figure, description, and a specimen of my *Trinectes Scabra*, a new genus of fish near to *Achirus* found in the river Schuylkill; it has only three fins, dorsal, anal and caudal. Also the description and figure of a large and beautiful new cat-fish from the river Tennessee, discovered in 1823, *Pimelodus lutescens:* it was three feet long, excellent to eat, of an olivaceous yellow colour, belly white, jaws equal, eyes round, tail forked, first dorsal falciform, second dorsal nearly as large as the anal."

By what means Mr. Rafinesque was enabled to send the figure, description, and specimen of this fish to France, may be learnt from the communication to us, which appears below as a note.* It will be observed that he has not even mentioned the name of Dr. Harlan, to whom alone he was indebted for the knowledge of the existence of this fish. His conduct is of a piece with what we find at page 28, speaking of the caves in Kentucky:—

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* PHILADELPHIA, March 28, 1832.

Dear Sir,—In that strange production, the Atlantic Journal, edited by Mr. Rafinesque, he states that the *Megalonyx laqueatus*, described by me in March 1831, in the Journal of the Academy of Natural Sciences, was previously named by him *Aulaxodon speleum.* It is difficult to make such a man responsible for any thing he does. I feel it necessary, however, to explain what his conduct has been towards me in this, and in another instance, that the public may understand what is due to him.

When I was engaged in the examination of the fossil bones alluded to, and had already placed the species in Mr. Jefferson's genus megalonyx, Mr. Rafinesque called upon me, and asked a great many questions concerning their nature and locality: he acknowledged himself utterly ignorant of them, and was evidently unapprized of the characteristic difference between the genus megatherium and megalonyx. These bones were personally collected by the late Mr. Clifford; and when they were purchased from his collection, the labels, stating that fact, were attached to them. Yet Mr. R., without giving any authority for it, states they were found in another place.

During the summer of 1830, I obtained from Mr. Carr, proprietor of Bartram's botanic garden, several species of fresh water fishes, among which was a specimen of Flounder [Pleuronectes] never before noticed as an inhabitant of the Schuylkill. Mr. R. called upon me one day, and as he was generally supposed to have some knowledge of ichthyology, I showed it to him. He asked permission to take it home that he might examine it at leisure. Since that time I have never seen the specimen, nor been able to get any account of it from him, that I could rely on. It appears, however, at page 20 of the Atlantic Journal, that he sent it to Baron Cuvier previous to March, 1831, as a new genus *Trinectes Scabra*, without mentioning the fact to me, or mentioning my name in the communication. I was, as I yet am, disposed to think this fish a new species of the genus Achirus of Lacep. or of Soles, totally deprived of pectorals, but a new genus it certainly is not. Mr. Ranfinesque appears determined to gratify his appetite for notoriety by unusual means, and altogether inconsistent with the respect due to the property of others. It is a course that will bring its own punishment with it. I remain, dear sir, yours very sincerely, RICHARD HARLAN.

"The principal fossil bones found in them, and come to my knowledge, belonged to—

"1. The *Megatherium*, or an animal very near it.

"2. My Aulaxodon speleum, since called Megalonyx laqueatus, by Harlan."

Now, in relation to this, we state, that there never was any bone resembling that of a Megatherium found in those caves; and as to the Megalonyx, the genus was so named by that eminent lover of natural history, Thomas Jefferson. The new species, M. Laqueatus, was first published by Dr. Harlan in March, 1831;* the bones of this animal were shown by him to this *Doctor* Rafinesque, who had never seen them before; yet he who complains of being wronged by others, not only attempts to supplant the species of Harlan and the genus of Jefferson, but insinuates that the first-named of these two gentlemen had endeavoured to supplant him. We wish Mr. Rafinesque to understand, that when any *pseudo* scientific publication is published here, calculated to mislead at home, and to discredit the country abroad, we shall proceed to unbombast it as soon as our leisure permits. He may cry mercy, and plead past services; but it won't do. One of our objects in relation to the geology and natural history of this country, is to endeavour to clear up all the old crudities that have brought natural science into a fog here; and if it were only to spare ourselves future trouble, we must cut up by the roots all the new-born nonsense that threatens to darken the subject still further.

Henceforward, we trust, Mr., or *Doctor*, or Professor Rafinesque—who it seems must be doing—when he finds *queer things*, such as *Mazamas*, *Panallodons*, and *Nephrosteons*, which he does not know what to make of, will do what men of sense do, show them to those who do; and not publish them—without figures too, in language that no naturalist can understand, and which was only endured in the bygone days, when all were ignorant alike, and when it was the custom to hold *omne ignotum pro magnifico*.

* See Month. Am. Journal of Geology, Vol. 1, p. 45.

ACCOUNT OF OPERATIONS TO FIND WATER IN THE DESERT BETWEEN CAIRO AND SUEZ.

From the Journal of the Royal Geographical Society of London.

We have been favoured with an interesting account of some successful attempts, made with great energy and perseverance, by Mr. Samuel Briggs, of Alexandria, to find water in the Desert, between Suez and Cairo. This is not only an important discovery for the natives of the country, but will also prodigiously facilitate the intercourse with India by steam.

The first experiments were made in the valley of Kesche, where the workmen bored, in one instance, to the depth of one hundred and sixty feet, through a fine sandstone, mixed with clay, without finding any humidity; and in another place to the depth of fifty feet, principally through a rock composed of fragments of silex and jasper, where they met with a hard rock which broke the instruments, and the attempt was consequently relinquished on that spot. The operations were transferred to the valley of Candelli. Here water has been found in a clayey stratum, at the depth of only thirteen feet, where a well is already established, to which the Arabs come for their daily supply. Above the clay is a bed of calcareous sandstone, five feet thick, through which the water filters; and in the stratum of clay three lateral galleries have been ingeniously struck to the extent of twelve or fourteen feet, which not only serve to collect the water, but, together with a further continuation of the well, to the total depth of twenty-one feet, form a reservoir of one thousand two hundred cubic feet of water. The whole is to be lined with stone and mortar, which will render it a work of perfect art; and what is most important is, that the water being found so near the surface, neither the labour of camels nor of machinery will be required to draw it.

Two other wells have been commenced in the same valley, with the same prospect of success. It is believed that, as the spot is only an hour, or an hour and a half's journey from the great chain of mountains which stretches across the Desert from the Nile to the Red Sea, the waters have there their source.

This enterprise has been projected by, and carried into execution at, the sole expense of Mr. Briggs. He has in his employ an able mineralogist, Mr. Albert Gensberg (a Swiss, we believe,)

who is still continuing his researches, and is confident of finding water, and establishing wells, at other parts of the route. The practical artificers are two Englishmen, named Hancock and Wood. The villages, where men and animals will not only be supplied with water, but with all other necessaries in their painful journeyings; and the names of the projector and executor, of this work will be remembered with gratitude by all future travellers in this hitherto sterile desert.

Above all, it is hoped that the enlightened ruler of Egypt will appreciate the merits of Mr. Briggs, whose success will facilitate the commerce and promote the prosperity of that country.

To the above may be also subjoined the following extract of a letter, dated, Alexandria, June 13, 1831, from Mr. Briggs himself, to the Earl of Munster, who has communicated it to the Royal Geographical Society:—

"My attempts to discover water in the Desert between Cairo and Suez have been crowned with success; and I hope all future travellers to and from India will feel the benefit of it, as well as the pilgrims to Mecca.

"I have had two English borers at work during a year and a half, at my expense; and *I mean to persevere till I have found water also on the other line of communication*, known to you, between Cosseir and Thebes, or Kenne.

"Ibrahim Pasha gives me every assistance in guards, tools, masons, &c., whenever sweet water is found; but the Hadgi know it is to the English they are indebted for this boon."

GEOLOGICAL SOCIETY OF PENNSYLVANIA.

Abstract of their proceedings, April 14th, 1832, Lieut. Col. Long in the chair—

A paper on the geology of the Alleghany Mountains, by R. C. Taylor, Esq. was read by Mr. Featherstonhaugh.*

Peter A. Browne, Esq. read a paper *on the rocks found in the vicinity of Philadelphia.*—These rocks are primary; no granite

* This paper, together with a section of the Moshannon Valley, were published in the last number of this Journal.

has been found, except in boulders and veins of other rocks. This rock is the general but not continuous Atlantic boundary of the United States. When Ashton street, in Philadelphia, was regulated, a boulder of granite, weighing several tons, was found in the gravel. The felspar was flesh-coloured, sp. gr. 2.727. Where it is found in veins, the felspar is white, and the sp. gr. 2.701. The river boulders vary in their constituents more than the inland ones. Mr. B. has found Porphyry with helyotrope among the first. The gneiss at Fairmount water-works contains white beryls, and schorl in granite veins, sp. gr. 2.620. The gneiss re-appears at the falls of Schuylkill, five miles from Philadelphia. The State Penitentiary, in Coates street, is built of this rock: it contains, in granite veins, green beryls, phosphate of lime, scapolite, &c. In some places the gneiss is entirely disintegrated, lying in extensive loose sandy beds. Mica slate is quarried near Lemon hill, and in Broad street; it is well displayed at the mill-dam upon old Fourth street, sp. gr. 2.038 to 2.712. This rock contains granite veins with white beryls, and hexagonal crystals of mica. The beryls, when first detached, are soft and friable, but become gradually harder. Near Bartram's garden, the mica slate is found in disintegrated and sandy beds. At Chesnut hill, the mica slate is nearly vertical. From Manayunk to the Plymouth dam, it becomes compact, and contains beryls, zeolite, cyanite, schorl, phosphate of lime, &c. The first hornblende rocks which appear near Philadelphia, are near Fairmount water-works; but further north, they may be traced from the Delaware to the west bank of the Schuylkill. They appear on the Delaware about a mile beyond the village of Frankford, at the forks of the Bristol and Bustleton turnpikes, and near Second street road. At Manayunk they pass into hornblende slate. Actinolite is found subordinate to this formation. Mr. B. succeeded in detaching a specimen of a very tough compact hornblende, on Second street road, near Frankford creek, and on examining it a few days afterwards, found the fractured surface spangled over with crystals of actynolite, similar to others he had observed on the exterior of the rock. At Streaper's hill, on the Ridge turnpike road, the hornblende rocks again appear. In a ravine at the side of the road, about 11 miles from Philadelphia, large boulders of hornblende are lying on clay slate; others are found on the surface further

to the north-east. Proceeding up the Schuylkill from Manayunk, the mica slate, near the soap-stone quarries, gradually passes into talcose rocks, confusedly piled upon each other. Serpentine, steatite, talc, chlorite, and other mineral substances, are here subordinate to this formation. The steatite (soap-stone) contains oxide of iron and tremolite. The chlorite slate contains octahedral iron.

A communication was read from a *Committee of the Cabinet of Science of Bradford County*, consisting of Messrs. Henry Wells, Ellis Lewis, Isaac Cooley, Bissel Chubbuk, and William Russell.

There is in Bradford county inexhaustible quantities of bituminous coal and iron. Indications of copper have also been discovered. Major Long, of that county, has detected gold and silver in particular rocks. The gold is found disseminated in a bed of hornstone. Limestone with marine shells is also found in this county: when prepared in the kiln, it is of a grey ash colour. A coarse-grained silicious sandstone is found on the waters of the Towanda creek, well adapted for mill-stones. The only coal-mines now open and worked in this county, are on the waters of the Towanda creek, a few miles south-west of the borough of Towanda. The coal is excellent, and is extensively used by the inhabitants in preference to wood. In the winter season, it is sent in sleds to Ithaca, Newtown, &c. The veins of coal are from three to seven feet thick, and are found a few feet from the surface. The coal-field is extensive, rests upon a general bed of sandstone, and the strata alternate with slate. The coal on the waters of Towanda is supposed to be part of a continuous deposit extending to the coal-mines of Blossburg in Tioga, and those of Lycoming in Lycoming county. The Towanda creek is navigable for the descent of rafts a considerable distance above the coal-mines, which are situated about twelve miles from the north branch of the Susquehanna river. Coal is also found in abundance about six miles from the borough of Towanda. Iron is found in the neighbourhood of the coal-mines, and in other parts of the county. No fossil coal plants have yet been found: it is supposed they are not so abundant in the bituminous coal-fields as they have hitherto been found to be in the non-bituminous ones. There are several salt springs

in the county, and a salt manufacturing company is established in Susquehanna county, at a salt spring on the dividing line with Bradford county. No rock salt has been found, neither have any wells been yet dug in this last county for brine. At Rome, eight miles north-east of Towanda, is a fine mineral spring, impregnated with sulphur, iron, &c. Inflammable gas rises in large bubbles from the bottom. The medicinal properties of this spring have been found very efficacious in cutaneous diseases. No natural caves have as yet been discovered in this county, nor any osteological remains, except an elephant's tooth. An exploring expedition, for the purpose of making geological examinations of the most interesting parts of the county of Bradford, is now preparing; it is intended to communicate the results to the Geological Society of Pennsylvania.

A communication on the geology of Wayne county, Pennsylvania, accompanied with a map and section, from Jacob P. Davis, Esq. and dated Bethany, Pennsylvania, was read. The following is an extract from it:—

"The principal features of the county of Wayne are, a continuous upland, occupying by far the largest portion of surface, the long narrow valleys by which this upland is indented, and a few incidental eminences to which the distinction of mountains is applied. The general average elevation of the upland is estimated at about thirteen hundred feet above tide water.

"Moosic mountain, near the western line of the country, rises above the upland about six hundred feet; having a total elevation at Rix's Gap, on the route of the Rail road, of nineteen hundred and ten feet above tide water. The term "gap," as applied to the passes of this mountain, does not signify a cleft or opening; the top of the mountain being continuous: it merely signifies a convenient slope. Beyond the northern extremity of the Moosic rises Mount Arrarat, which is about the same height as the Moosic. Besides these there are a few eminences of but minor note.

"The upland, with its appurtenant valleys, appears to afford the most interesting variety, the features of which are particularly defined by the course of the waters. All the larger streams have their sources at or near the summit of the upland, increasing in their passage by the confluent springs and rivulets;

the upland affords a hollow for the waters which enlarges as the waters advance, until at length the acclivities gradually assume a mountain aspect. The greater part of these inequalities, however, present no serious obstacle to agricultural operations. The slopes are generally gradual, and with some exceptions near the larger streams, every part is susceptible of cultivation.

"Delaware river bounds the north-eastern side of the county. It receives from Wayne county, besides the Lackawaxen river, the waters of the northern end of the county, and much of the eastern waters. There is much alluvial bottom land along the margin of the river; the upland acclivity is lofty, bold, and sometimes precipitous. The greater part of the river shore in Manchester township, from the mouth of Great Equinunk creek, downwards, is bound by lofty perpendicular rock, from the water's edge, which effectually interrupts a direct land communication along the river for that distance.

"Lackawaxen river flows through the middle of the county, in a deep valley, which no where exceeds half a mile in breadth. It unites the waters of the greater part of the county, which it discharges into the Delaware river. The bottom of this valley is, for the most part, an alluvial flat of fertile quality. The principal branches of this river are, the Dyberry, which it receives from the north, flowing through a valley similar to the Lackawaxen valley; the west Branch, which is considered the principal branch of this river, flows through a similar valley, and unites its waters with the Dyberry, near Honesdale, forming together the true Lackawaxen river. The Middle creek enters the Lackawaxen near the south-eastern line of the county. It is a stream of considerable magnitude, but its channel is rocky and its course very rapid. The Wallenpaupac creek, on the county line, is a considerable branch of the Lackawaxen, and has much alluvial flat extending almost its whole length. It has a high cataract near its mouth. For the last fifteen miles the creek, after a previous rapid course, flows in a sinuous channel, with scarcely any sensible motion. Arrived at the head of the falls, the bed of the creek appears suddenly depressed, and forms a chasm, into which the water pours down a depth of near seventy feet, and then rushing along in a deep rocky channel, is precipitated over three successive cataracts within a distance of

a mile and a half to the mouth of the creek; producing a total fall in that distance of a hundred and fifty-six feet. The width of the creek above the falls is eighty-three feet: the scite of the upper fall is improved by two saw mills and a grist mill, a short distance above which a wooden bridge connects the route of the Milford and Owego turnpike.

"Geological inquiries, in this county are restricted within a small space. The far greater part of the county is covered by its native forest, and has been but very little, if at all, regarded by geological science. The productions of the soil, where cultivated, yielding an ample remuneration to industry, no excavation has been made in search of minerals, and few for any other purposes. Our inquiries are therefore directed to the occasional uncovered rock, and the remains detached by their decomposition, and these, for the most part, only enable us to generalize a few facts.

"The geological formation of Wayne county is transition. Its stratified rocks consist of brown argillaceous slate, graywacke, graywacke slate, and an impure limestone. The Moosic mountain is composed of conglomerate or pudding stone, resting on graywacke, and containing beds of amygdaloid. An outlayer of conglomerate is also seen in Mount Pleasant, near Centreville, the upper surface of which just projects above the soil. A bed of clay slate occurs near the mouth of Cawley brook, in Dyberry township, interposed between strata of graywacke slate. This rock also occurs in beds on the western side of Moosic mountain, above Belmont coal mine.

The brown slate appears to be the transition clay slate, or argillite of geologists. It readily splits into thin plates, which exhibit glimmering scales, probably mica. Its colour is usually brown, by oxide of iron; it is, however, sometimes of a grayish colour. The clay slate is a variety of argillite. It is of a fine texture: its fracture is rather splintery than slaty, and exhibits a glossy lustre. Its colour is a smoke gray, or clay colour. It is used for whet-stones, for which it is very well adapted.

"The conglomerate is composed of silicious pebbles of various forms, but generally rounded, united by a cement. It is frequently employed for mill stones, and is said to be nearly equal in quality to the burr. It contains veins of sulphuret of iron. feldspar and quartz.

"The limestone is of a coarse texture, and uneven fracture, and sometimes slaty. It is fusible at a white heat into a black glass, which denotes the presence of much silicious matter.

"The strata of brown slate and graywacke slate most frequently alternate, and are of considerable thickness and extent, declining from the horizon at an angle of thirty degrees or more, and dipping generally towards the north-west. It is frequently the case that the several strata form successive ridges, facing the south-east, which seem to rise behind each other like steps to the summit of the upland. In such cases the strata are from ten to a hundred feet in thickness; principally of graywacke slate and brown slate, alternating with occasional small strata of graywacke and limestone.

"In the vicinity of the Belmont coal mine, on the western side of Moosic mountain, is found, an argillaceous oxide of iron, sometimes called clay iron stone, in nodules and masses of various forms, imbedded in shale. Some of the nodules exhibit only a shell filled with a dark bluish liquid, of the consistence of paint; or with a compact substance of the same colour, but always capable of being cut with a knife. A specimen of this ore yielded 33 per cent of metallic iron. This mine is not worked. The district is yet covered by its native forest. Sulphuret of iron is also found in the shale at this place.

"I am not acquainted with the existence of any other minerals in this county than such as I have noted. There can be no doubt, however, that many will be discovered when the country becomes more improved, and its forests cleared off. To such a conjecture the properties of the soil and the nature of the formation afford many indications. The anthracite region approaches the western side of the county, but does not extend into it. There are neither salt nor salt springs known in this county; the only mineral springs known are chalybeate, on the western slope of Moosic mountain, near Belmont mine, and near Big Beech pond, in the southern part of Damascus township."

Mr. Featherstonhaugh presented, on the part of Lieut. Col. Long, an original coloured sketch, showing the blue ridge, and the adjacent country, from the Susquehanna river to the Mississippi river.

METEOROLOGICAL OBSERVATIONS,

Made at Wilmington, Delaware, by Henry Gibbons, M. D.

SUMMARY FOR MARCH, 1832.

	Therm.	*Barom.*
Average at sun-rise,	34°.81	*in.* 29.87
Average at mid-day,	49°.42	29.83
Average at 11 o'clock, P. M.	38°.23	29.84
Monthly average,	42°.115	29.85
Maximum, 12th,	67°. 1st,	30.30
Minimum, 18th,	12°. 12th,	29.37
Range,	55°.	.93
Warmest day, 12th,	60°.55	
Coldest day, 18th,	18°	

Proportion of clear weather,	*days* 21
Proportion of cloudy,	10
Whole days clear,	14
Days on which snow fell,	1
Days on which rain fell,	7
Depth of snow,	*in.* 2
Depth of rain,	2.55
Quantity of water,	2.80
Northerly winds prevailed,	*days* 11
Easterly,	5
Southerly, (S. to W.)	15

An aurora, on the evening of the 27th, followed by easterly winds. Clouds electrified twice; a heavy thundergust on the 12th. Winds not very variable; but blustering and frequently high, supporting the character of March. Two transient, incomplete, easterly storms. The weather of this month was remarkable for its sudden transitions from warm to cold. The temperature of the thirteen first days was pleasant and uniform, averaging about 53° at noon. A severe thunderstorm took place on the 12th, which was not followed immediately by much decrease of temperature. But a N. W. wind set in the next day, and the thermometer fell from 57° (at 2 p. m.) to 35° (at 11 p. m.). The next morning it stood at 20°. During this and the eight successive days, the mean temperature at noon was 39½°. A change still more remarkable took place on the 17th, when the mercury fell from 47°, to 17°, between the hours of 2 and 11 p. m., during a violent snow-storm from N. West. On the morning of the 18th, it was at 12°, a degree of cold extremely unusual at this late period. The weeping willow had put forth its leaves, and the blossoms of the Lombardy and Athenian poplar were out. The leaves of the one, and the blossoms of the other, were completely destroyed, and the buds of the willow were so effectually killed, that the tree continued without any trace of vegetation till after the middle of April, when it put forth a new set of buds. The fruit of the peach-tree was killed by the same frost, in the unexpanded bud, so that few, comparatively, of the blossoms, subsequently opened.

SCIENTIFIC AND GENERAL MEMORANDA.

Tyrian Purple Dye.—The shells from which the celebrated purple dye of the ancients was extracted, named by Pliny, the Murex and Buccinum, have given occasion to disputes among modern naturalists as to the species meant. M. Lesson, upon comparing the mollusca now found in the Mediterranean, with Pliny's description, is of opinion the Buccinum is the Ianthina. It is a pelagian shell, and extremely numerous. It sustains itself on the surface of the sea by air vesicles, which Pliny calls a glutinous wax; and as soon as it is taken out of the water, there escapes from it a very pure and very brilliant violet rose colour. Each shell contains an ounce of this in the dorsal vessel. By means of alkalies this colour is changed to green. The Ianthina abounds equally in the Atlantic as in the Mediterranean; and at certain seasons the beaches of St. Helena and Ascension are entirely covered with them. From experiments made with this colouring matter, it appears to be a valuable reactive, turning red when treated with acids, and blue with alkalies. Oxalate of ammonia gives a deep blue precipitate, and nitrate of silver a prttey ash blue for painting in water colours.

Mode in which the common Frog takes its food.—The Rev. Mr. Bree in a communication to the conductor of the Magazine of Natural History, states,—"The friend to whom I am indebted for having first called my attention to this amusing exhibition, was himself introduced to it by mere accident. He happened to be re-potting some green house plants, and meeting with a moderate sized worm among the roots of one them, he carelessly threw it aside into a damp corner near the green house. Almost immediately a frog issued from his lurking place hard by, commenced his attack upon the worm, and soon dispatched it. Another worm was thrown to him, which he treated in the same manner. But the amusing part of the business is to watch the manner in which the frog first notices his prey; and this I can compare to nothing so aptly as to what, indeed, it very much resembles, a pointer dog setting his game: he makes, in short, a dead set at it; oftentimes, too (if the relative position of the two animals so require it,) with a slight bend or inclination, more or less, of the forepart of the body to one side, just as we often

see a pointer turn suddenly, when the game is one side of him, and has approached very near before he has perceived it. After a pause of some seconds or more, the frog makes a dart at the worm, endeavouring to seize it with his mouth; in this attempt he frequently fails more than once; and generally waits for a short interval, acting the pointer, as it were, between each attack. Having succeeded at last in getting the worm into his mouth, if it be a large one, he is unable to swallow it immediately and all at once; and the portion of the worm which yet remains unswallowed, and extends out of the mouth of its destroyer, of course wreaths about, and struggles with a tortuous motion. With much, but somewhat grotesque dexterity, the frog then employs his two fore feet, shoving, and bandying the worm, first with one, and then with the other, in order to keep it as nearly as may be in the centre of his mouth, till the whole is swallowed. Any of your readers who are fond of marking the actions and habits of animals are strongly recommended to try the experiment. They have only to find a frog, taking care not to alarm him more than need be, and throw down a worm near him, and they will be pretty sure to be gratified by the sight of what I have endeavoured, however imperfectly, to describe. I ought to add that, to be successful, the experiment should be made in the summer, say June or July; as I am informed, (but do not vouch for the fact,) that, except for a few months in the summer, the frog is wholly abstemious."

Bi-valve Mouse Traps.—A person at Plymouth, having placed some oysters in a cupboard, was surprised at finding, in the morning, a mouse caught by the tail, by the sudden collapsing of the shell. About forty years since, at Ashburton, at the house of Mrs. Allridge, known by the name of the New Inn, a dish of oysters was laid in the cellar; a large one soon expanded its Valves, and two mice bounced upon the "living luxury," and were at once crushed between the valves. The oyster, with the two mice dangling from its shell, was for a long time exhibited as a curiosity. Carew, in his history of Cornwall, tells of an oyster that closed on three mice. An appropriate instance is also epigrammatically recorded in the Greek anthology.

M. N. H.

A Geological Manual, by Henry T. De la Beche, F. R. S. F. G. S. &c. &c.—We have received the second edition, corrected and enlarged, of this very instructive work. The lists of organic remains have been corrected, and additions made to them, as well as to the body of the work.

On the Means by which certain Animals ascend the Vertical Surfaces of highly polished Bodies.—Mr. Blackwall has read a paper before the Linnæan Society of London, showing that insects effect their progress upon the vertical sides of smooth objects, by the agency of an *adhesive secretion*, emitted by the instruments they employ in climbing, and which proceeds from the fimbricated under surface of the dilated extremities of the toes.

Services rendered to Natural History, by E. W. A. Drummond Hay, Esq.—This gentleman, who is British resident consul at Tangier in Morocco, has set a bright example to all official persons resident in foreign countries, and deserves to be honourably noticed by naturalists. He has lately sent to the Zoological Society of London, two Ichneumons (*Herpestes Pharaonis.* Desm.), and a pair of striped Barbary mice (*mus barbarus.* Linn.) With them came also four young ostriches, as a present to the king of England, from the sultan of Morocco. They were taken in a region of the Desert called Hamadah. Although they have not yet acquired their adult plumage, yet the precocity of the sexes was indicated by unequivocal actions, whilst at Tangier. The king has presented the ostriches to the Zoological Society.

Petrefacta Musei Bonensis, by Professor Goldfuss.—The third part of this beautiful work has just appeared, and is fully equal to the preceding ones. It contains the *stellerides*, *encrinites*, and *serpulites*, with some additional species of corals. It contains twenty-five splendid lithographs, and eighty pages of letter-press. The learned author has paid much attention to synonymes, and has done a great deal towards clearing up the confusion they have created.

Birds of Europe.—Mr. Gould, author of "*Illustrations in Ornithology, from the Himalay mountains*, is about to publish a new work on the birds of Europe, the first part to appear on the

1st of June, 1832; it is to be published quarterly until completed. Each quarterly number is to contain twenty plates, imperial folio; fifteen of which are to be descriptive of British birds, and five of birds of the European continent. Price to subscribers of each part, paid on delivery, three pounds sterling.

A Manual of the Land and Fresh-water Shells of the British Islands, with coloured Plates of every Species.—This is the title of a work lately published by Dr. Turton, author of the *Conchological Dictionary.* Collectors of land and fresh-water shells will receive great assistance from this beautiful and accurate volume, in the arrangement of their *shells.* It is to be regretted, however, that it tends to continue the delusion about these testaceous coverings, as if their beauty and scarcity were the main objects of the study; and not the structure, faculties, and habits of the animals that lived in them.

The Tail of the Caterpillar becomes the Head of the Butterfly.—A writer in a late number of the Magazine of Natural History, observes, "I have lately observed a curious fact, which I have never seen noticed in any book, that it is the tail of the caterpillar which becomes the head of the butterfly. I found it hard to believe, until I had convinced myself of it, in a number of instances. The caterpillar weaves its web from its mouth, finishes with the head downwards, and the head, with the six front legs, are thrown off from the chrysalis, and may be found dried up, but quite distinguishable, at the bottom of the web. The butterfly comes out at the top. Is this fact generally known?"

Discovery of a Reef in the Pacific.—A dangerous reef has been discovered in the Pacific ocean, among the Caroline Islands, the N. E. extremity of which is in latitude 7° 36′ N. and longitude 155° 18′ E. It was found to lie in a N. E. and S. W. direction, and is so extensive, that the whole of it could not be seen from the N. E. extremity. It is about fourteen miles in a W. S. W. direction from Island Bordelaise, discovered in 1826. The discovery is due to the ship Larkins, W. Campbell, master; and, as here given, is extracted from her log, bearing date 23d February, 1830.—*Jour. Royal Geo. Soc. of London*, 1830–31.